

SUPERPOLISHED SI COATED SiC OPTICS FOR RAPID MANUFACTURE OF LARGE APERTURE UV AND EUV TELESCOPES, Phase I

Completed Technology Project (2004 - 2004)



Project Introduction

SSG/Tinsley proposes an innovative optical manufacturing process that will allow the advancement of state-of-the-art Silicon Carbide (SiC) mirrors for large aperture UV and EUV applications. The manufacturing process combines three critical technologies: a slip cast, Reaction Bonded (RB) SiC, an amorphous silicon (Si) coating, and Computer Controlled Optical Surfacing (CCOS) technology. This combination of technologies addresses two critical areas required for enabling cost effective precision optics for large aperture UV and EUV applications: lightweighting of the optical substrate and polishing effort required for reaching final figure and finish. The proposed optical manufacturing flow provides solutions in both of these areas. The ability to near net shape lightweight RB SiC significantly reduces the machining required to prepare the substrate for optical surfacing. The use of a Si-coating on the RB SiC makes it possible substantially improve the removal rate-reducing the time and cost required to precision figure and finish the optic. CCOS superpolishing techniques will be developed that deterministically achieve excellent figure accuracies (<0.01 waves RMS) and low microroughness (< 10 Angstroms RMS) for very low areal densities (~ 10 kg/m² at an aperture of 1 meter). Phase 1 process development and demonstration will lead to flight-ready optics in Phase 2.

Anticipated Benefits

A low-cost process for producing thermally stable SiC optics with low surface roughness is required for UV and EUV lithography systems used in the semiconductor industry. Grazing incidence source collectors and imaging systems will benefit from successful Phase 1 and Phase 2. Government applications include optics for high energy lasers and x-ray sources such as National synchrotron sources. Superpolished Si-coated SiC precision aspheric optics are required for large aperture space-based UV and EUV missions. The developed optical manufacturing process will provide significant cost and schedule advantages for NASA Earth and Space Sciences including Solar Physics experiments with apertures similar to JWST or larger.



SUPERPOLISHED SI COATED
SiC OPTICS FOR RAPID
MANUFACTURE OF LARGE
APERTURE UV AND EUV
TELESCOPES, Phase I

Table of Contents

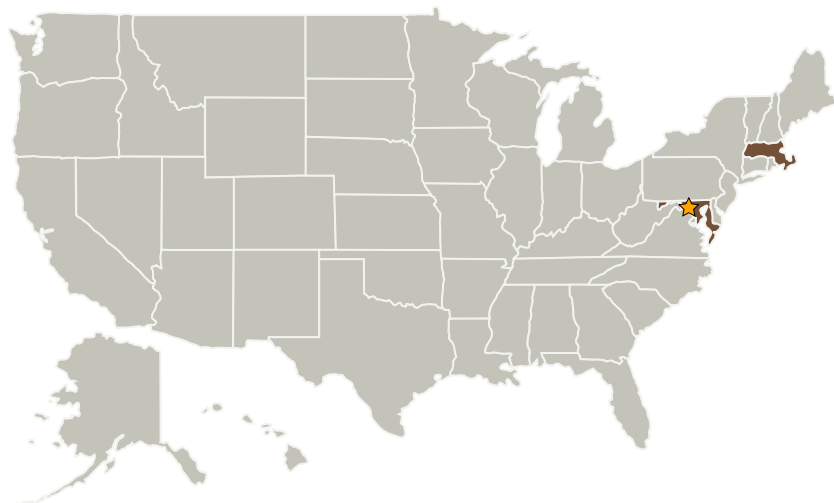
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Areas	2

SUPERPOLISHED SI COATED SIC OPTICS FOR RAPID MANUFACTURE
OF LARGE APERTURE UV AND EUV TELESCOPES, Phase I

Completed Technology Project (2004 - 2004)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
SSG Inc	Supporting Organization	Industry	Wilmington, Massachusetts

Primary U.S. Work Locations

Maryland	Massachusetts
----------	---------------

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Peter N Blake

Principal Investigator:

Jay Schwartz

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - TX12.4 Manufacturing

Continued on following page.

SUPERPOLISHED SI COATED SIC OPTICS FOR RAPID MANUFACTURE OF LARGE APERTURE UV AND EUV TELESCOPES, Phase I

Completed Technology Project (2004 - 2004)



Technology Areas (cont.)

- └ TX12.4.3 Electronics
and Optics
Manufacturing Process